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Life Insurance.

A Lecture delivered at the Opening of
the New Building of the Chicago
Post-Graduate Medical
School,

Wednesday Evening, January 7, 1891.

BY

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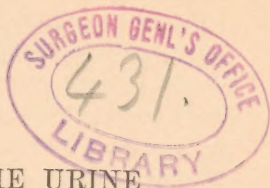
PROFESSOR OF URINARY AND RENAL DISEASES AT THE
CHICAGO POST-GRADUATE MEDICAL SCHOOL.

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THE examination of the urine of applicants for life insurance has for its object the determination of the presence or absence of diseases of the urinary organs which abridge the normal expectancy of life. While it is absolutely impossible to accurately determine many of these questions without a careful analysis of the urine, in many cases it is equally impossible to determine them by uranalysis alone without taking into consideration the concomitant conditions and states of the system. By examination of the urine, therefore, the widest possible scope of the term is intended in order that all conditions which bear directly upon urinary diagnosis may be included.

In a case of suspected pulmonary tuberculosis the medical examiner for a life-insurance company would by no means confine his investigation of the question to a physi-

cal examination of the applicant's chest. He would also carefully note the applicant's weight, the frequency of his pulse, and especially his temperature; nor would he fail to interrogate the applicant as to the presence of any cough, expectoration, or hæmoptysis; and, finally, in order to doubly assure himself, he would go carefully over the family history.

Auscultation and percussion would sometimes leave the most expert medical examiner in doubt as to the actual condition of the organs within the chest if he did not carefully note the symptoms above mentioned.

About sixty years ago Richard Bright, of London, announced to the medical world that albuminuria was the index of certain diseases of the kidneys which were invariably and speedily followed by death. A scientific diagnosis so incomparably simple in its construction, and apparently so unanswerable as an ultimatum, could not fail to exercise a strong fascination over the medical mind of the day, and accordingly the test tube constituted at once the ordeal from which there was no appeal in cases of suspected renal disease. A few years later, however, it was conclusively shown that occasionally certain forms of renal disease caused death without any accompanying albuminuria whatever. Indeed, this fact did not escape the keen observation of Bright himself in his later researches. And now, within the past few years, we are assured by numerous and most trustworthy authorities that albuminuria is not at all uncommon in otherwise perfectly healthy people, and that in special cases it in no wise abridges the life, or even the health, of the individual.

It would, therefore, seem perfectly clear with regard to albuminuria that the time has arrived when we must go back of this mere fact and take into consideration its accompanying symptoms and phenomena before we are able

to arrive at accurate conclusions as to the presence of disease of the kidneys in any given case. Indeed, as in the case of the lungs, so with the kidneys, when the local symptoms leave the question of the presence of disease in the least doubt, then the whole organism must be closely scanned for those general landmarks which are likely to guide us to correct conclusions in the matter. In the following directions for conducting examinations of the urine for life insurance, therefore, the most important facts and data bearing upon the question of urinary diseases, aside from the urine itself, will be considered in their appropriate places.

The Urine.—The most important preliminary in examination of the urine, and one that a due regard for the interests of the company should always demand, is to have the specimen of urine to be submitted to examination voided in the presence of the medical examiner. This important preliminary is easily enough accomplished if the applicant be notified not to void his urine for from two to three hours before presenting himself for examination. The medical examiner should, of course, provide in his office the proper facilities for collecting the specimen of urine to be examined. If, for any special reasons, it is impossible to carry out these requirements, the medical examiner should satisfy himself that the urine he is about to examine has been voided by the applicant.

The next preliminary in dealing with the case relates to the time of day the urine is voided. In all cases where practicable it should be so arranged that the sample of urine to be examined be voided about three hours after a meal of mixed food. It is high time to stamp out the popular fallacy that the urine voided on rising in the morning is the most desirable for purposes of uranalysis. Of all urines, that voided in the morning before breakfast is the

least likely to contain either albumin or sugar. The urine voided from three to four hours after a meal gives us the effects of both food and exercise upon the secretion.

Finally, only freshly voided urine, or urine perfectly preserved from change, should be submitted to chemical or microscopical examination. In all cases it is preferable to examine the urine not later than from six to ten hours after it has been voided. If for any reason this is impossible, then the freshly voided urine should be treated with resorcin* in the proportion of five grains to every two ounces of the urine, when it may be set aside without fear of change for several days.

Physical Examination.—The normal color of urine is pale yellow, but there may be considerable variation within the range of health. Pathologically, it may vary from the color of water through the various shades of yellow and red, deepening into black.

Should the urine lose two or three shades of its normal yellow and appear decidedly greenish in hue, it would suggest the possible presence of sugar, as these are the usual conditions when sugar is present in any considerable quantity.

Blood and bile pigments impart their own peculiar tinges to the urine, the depth of the color coarsely indicating the relative quantity present.

Normal urine when freshly voided is usually transparent, but urine containing sugar or albumin may also remain perfectly clear.

On the other hand, urine may be opaque when voided, owing to the presence of the earthy phosphates of calcium

* In examining the urine for sugar with copper tests, resorcin causes slight change, but the reaction is unlike that due to sugar and is easily recognized.

and magnesium, and in such case the addition of a few drops of acid restores the normal transparency.

Again, urine is sometimes turbid, owing to the so-called mixed urates of sodium, potassium, calcium, and magnesium, and in such case the normal transparency is restored by the application of gentle heat.

Pathologically, the urine may be turbid from the presence of pus or other organic products, and in such case neither heat nor acidification restores the transparency, and this suggests very strongly the presence of disease of the bladder or some portion of the urinary tract. But if I were asked to choose a single symptom which would most uniformly indicate organic disease of the kidneys, I should name an habitual departure from the normal range of specific gravity of the urine, more especially a reduction thereof.

If the tubular structure of the kidney is impaired by disease, the organ is unable to secrete the normal amount of solids with the urine, and the degree of impairment is pretty uniformly indicated by the degree of daily reduction of the specific gravity of the urine as a whole.

The normal specific gravity of the urine is generally considered to range between 1.015 and 1.025. I am, however, inclined to regard the normal range within more narrow limits, especially as regards reduction, and therefore by habit have become suspicious of organic disease when the specific gravity habitually sinks below 1.018. As a matter of fact, which I can attest from many thousands of observations, normal urine usually fluctuates between 1.018 and 1.023 in specific gravity, being more likely, however, to rise above than to sink below the above-named range.

For the purpose of accurately determining the specific gravity of urine, the ordinary urinometer sold in the shops is not to be depended upon. It is probably strictly within the bounds of truth to assert that not more than one in thirty

of these instruments is accurate, and their errors mark all variations up to fifteen or more degrees. The urinometers made by E. R. Squibb are a noteworthy exception to this. Each urinometer sent out by this manufacturer is carefully tested, and any variation from the correct standard is marked on the case. The Squibb urinometers are graduated to read at a temperature of 77° F. instead of 60° F., as are the more common instruments. This corresponds more nearly with the temperature of the rooms in which most urines are examined. In taking the specific gravity of the urine, it is advisable always to use a Squibb's urinometer. The temperature of the urine should first be taken with the thermometer which is provided with each Squibb's urinometer, and for every 7° F. of temperature above 77° F., one degree must be added to the specific gravity as marked by the urinometer. When the urine is examined immediately after having been voided, its temperature will range from 88° to 95° F., in which case two degrees must be added to the specific gravity recorded by the urinometer. If, on the other hand, the urine has long been voided, in rooms of ordinary temperature, it will not vary more than two or three degrees from 77° F., in which case no temperature corrections will be necessary.

If the specific gravity of the urine be found below 1.018, and especially should it descend to 1.016 or under, the whole twenty-four hours' urine should be collected and a sample of the whole product should be tested. If it is found that such a sample shows a specific gravity below the normal range, other evidences of renal disease (to be considered later) must be carefully searched for, but more especially albumin. On the other hand, if it is found that the specific gravity of the urine rises above the normal range, search should immediately be made for sugar.

Chemical Examination.—The chemical reaction of nor-

mal urine—*i. e.*, of the whole twenty-four hours' product—is nearly always acid. The degree of acidity varies very much at different times of the day, and especially with regard to food. Shortly after a meal its acidity begins to diminish, and in from three to four hours the alkaline tide usually reaches its height; occasionally, though rarely, the acidity may become so diminished at such times that the urine gives an alkaline reaction with test paper.

The urine may become alkaline either from fixed alkali (potash or soda) or from volatile alkali (ammonia). It is important to distinguish between these two, as in the first case it merely reflects a condition of the blood, while in the second case it is nearly always the result of chronic inflammatory conditions of the lower urinary tract, notably the bladder. If red or violet litmus turns blue in contact with urine just voided, and *remains blue* upon drying, the reaction is due to fixed alkali. If, on the other hand, the paper *returns* to the original red or violet upon drying, the reaction is due to volatile alkali—ammonia.

Of the morbid chemical products found in the urine, those that most deeply concern medical officers of life-insurance associations are *albumin* and *sugar*; therefore, for present purposes, what is about to be said upon the chemistry of the urine will be chiefly confined to these two substances.

Albumin.—Perhaps the most popular method of searching for albumin in the urine at present is by means of Heller's nitric-acid test. The process is exceedingly simple, as follows: Clear, chemically pure nitric acid is poured into an ordinary test-tube to the depth of an inch. Upon this column of acid the urine is gently floated to the depth of an inch, care being taken to avoid mixing the acid and the urine. To avoid the latter, the urine may be delivered from a pipette, the test-tube being held obliquely, which checks

the force of the stream, and the urine, being the lighter of the two fluids, floats upon the surface of the acid. When the stratum of urine and that of the acid come in contact, if albumin is present in the urine a white zone immediately appears at the junction of the two fluids.

This test is one of considerable delicacy, and it possesses the advantage of great readiness and convenience in its application. It has, however, at least two sources of error which should be borne in mind. It may cause a whitish zone of precipitated urates, or a yellowish-white cloud with certain oleoresins sometimes present in the urine, notably with copaiba. The zone of precipitated urates is situated *above* rather than *at* the line of junction of the acid and urine, the cloud is less sharply defined than that due to albumin, and, lastly, the precipitated urates are dissolved upon the application of gentle heat. The cloud due to oleoresins disappears upon the addition of alcohol.

A more trustworthy test for albumin in the urine, when properly employed, is the ferrocyanic. The best method of applying this test is as follows: Have on hand two solutions—first, a saturated aqueous solution of citric acid; second, a saturated aqueous solution of ferrocyanide of potassium. Pour into an ordinary test-tube the urine to be tested to the depth of about three inches, and add sufficient of the citric-acid solution to thoroughly acidify the whole. Wait for a few minutes for the development of any cloud which might appear from the presence of mucin. If the test remains clear, add half a drachm or so of the ferrocyanide solution, and, if albumin is present, the urine quickly assumes a milky turbidity, more or less pronounced in proportion to the quantity of albumin present.

Should the mucin reaction occur upon the addition of the citric acid, filter carefully through doubled Swedish filter-paper, and add the ferrocyanic solution as before.

The ferrocyanic test is unchanged by peptones, vegetable alkaloids—as quinine, strychnine, etc.—or by oleoresins in the urine; and, moreover, as above applied, it is not subject to error from the presence of mucin—the most difficult of all errors to avoid in testing for albumin in the urine. Finally, the ferrocyanic test responds to all modifications of albumin, and it ranges in point of sensitiveness as equal to the nitric-acid test in whatever form the latter may be employed.

Having determined the presence of albumin in the urine by one or both of the above-mentioned tests, it will be useful to know the quantity thereof. This is most readily ascertained by Esbach's method, which is as follows: First prepare a standard test solution according to the following formula:

R Picric acid..... 10 grms.;
 Citric acid..... 20 “
 Distilled water to one litre. M.

Fill the albuminometer tube with the urine up to the letter U, then add the test solution to R. Close the tube with the stopper and invert several times until the urine and test solution are thoroughly mixed. Stand the tube in a rack for twenty-four hours, and then read off the number of grammes of albumin to the litre, as will be indicated by the numbers on the side of the tube, which range from 1 to 7. If it is desired to know the percentage of albumin present in the urine instead of the number of grammes to the litre, remove the decimal point one place to the left—thus, 5 grammes to the litre would be 0·5 per cent. of albumin. It will be observed that Esbach's albuminometer tubes are so graduated that their highest gauge is 7 grammes per litre—0·7 per cent. of albumin. If, therefore, the urine is very highly albuminous, it should be diluted with one or two volumes of water before testing. The product may thus be

multiplied by two or three, according as the volume is doubled or trebled.

Significance of Albuminuria.—The belief has been rapidly gaining ground of late among our ablest authorities that certain forms of albuminuria should not necessarily debar such subjects from the privileges of life insurance. While the medical directors of life-insurance associations, as a rule, do not accept subjects of albuminuria—and I think wisely so, as yet—still, it is all-important to distinguish between the so-called functional forms of albuminuria and those clearly due to dangerous renal lesions. In order to clearly establish such questions, a number of important matters must be carefully considered.

Quantity.—If the quantity of albumin present in a given specimen of urine is large—say four or five grammes to the litre or over—the application should be unconditionally declined, for such condition points without doubt to grave organic disease of the kidneys. On the other hand, it must be most distinctly understood that *small quantities of albumin in the urine* constitute no evidence whatever that the kidneys are not seriously damaged. There is no doubt that a neglect to strictly observe this axiom has resulted in foisting upon life-insurance companies hundreds of subjects affected with hopeless and incurable diseases of the kidneys, and thus incurring heavy pecuniary losses. The medical examiner will therefore bear in mind that the most hopeless of all forms of Bright's disease—interstitial nephritis—often runs through its whole course with the appearance of but small quantities of albumin in the urine; indeed, under such circumstances, the urine may contain *only occasional traces of albumin*. It is these occasional traces of albumin in the urine that the company depends upon its medical officers to find and report as carefully as the very largest amounts. A false and highly mischievous notion

seems to have prevailed quite widely in certain circles—viz., that the slightest traces of albumin in the urine are of no grave significance—and it is high time that this notion was thoroughly stamped out. In 1886 an applicant for life insurance was referred to me for special examination by the medical officers of a prominent life-insurance association. His urine contained a mere trace of albumin, but other symptoms indicated the presence of grave renal disease, and accordingly I advised the company to decline the application unconditionally. Within six months thereafter he was accepted by another company, and his life was insured for \$10,000, which the company was called upon to pay, in consequence of his death, before the second annual premium was due.

Age.—The age of the subject bears very strongly upon the prognosis in all cases of albuminuria. It may be laid down as a pretty safe rule that subjects of albuminuria beyond forty years of age are ineligible for life insurance, and this applies to all grades as to quantity or constancy.

On the other hand, if the subject is under thirty years of age, certain circumstances may render the prognosis of albuminuria less grave. It may be stated that most of the cases of so-called functional albuminuria occur in young subjects under thirty. The circumstances usually accompanying such cases are: Albuminuria, often intermittent and always moderate in grade, $\frac{1}{4}$ to 2 grammes to the litre; specific gravity of the urine, up to and often above normal; absence of renal casts from the urine; normal condition of the heart and arteries; and the subject otherwise in reasonably good health. The acceptance or rejection of such subjects should, of course, rest with the home office after receiving a careful presentation of all the facts.

Habits, Constitution, etc.—The life habits of the applicant bear importantly upon the prognosis of albuminuria.

If the applicant has always been a large eater, and his appetite has inclined largely to meats, the albuminuria is most likely to be due to interstitial nephritis. No fact is more widely understood now than that chronic Bright's disease is most frequently the result of excessive meat eating. In the great majority of cases the disease arises after middle age from long overtaxation of the kidneys in eliminating the excessive nitrogenous waste occasioned by overingestion of lean meat.

On the other hand, albuminuria in the opposite type of subjects—the spare eater, the dyspeptic, the constitutionally weak or defective—is frequently the result of amyloid lesions of the kidneys. Further evidences may usually be found if sought for in the family history—such as of tuberculosis, syphilis, or struma.

Circulatory Conditions.—Certain conditions of the circulation may be said to be so far characteristic of chronic Bright's disease that they are *always* present when chronic interstitial nephritis is present. These may be broadly stated to be increase of the circulatory forces, which is indicated by increased tension of the pulse; accentuation of the second cardiac sound; and, ultimately, cardiac enlargement, notably of the left ventricle.

It is perfectly true that we may have increased tension of the pulse from other causes—such as atheroma of the arteries; we may even have cardiac enlargement, with its accompanying symptoms, in the absence of chronic Bright's disease. This, however, in no wise impairs the value of the circulatory changes as negative symptoms, for, if these are absent, we are able to say that chronic Bright's disease is absent. The features of the circulation associated with chronic Bright's disease are: 1. Increased tension of the pulse, best shown by the sphygmograph, but easily detected by the finger. The pulse is full, hard, and pronouncedly

incompressible. 2. The second sound of the heart is sharply accented and sometimes duplicated, as heard best in the second right costal interspace, near the sternum. 3. The area of cardiac dullness may be found abnormally extended below and to the left, indicating enlargement of the left ventricle, which is pretty sure to appear sooner or later. The last-named condition may not appear until the late stages of the disease, but the two former symptoms are always present in chronic interstitial nephritis (granular, contracting kidney), no matter how recently the disease has been established.

Nocturnal Urination.—One of the most constant and valuable indications of certain forms of renal disease is the habit of rising regularly at night to void the urine. Of course, bladder irritation due to cystitis, or retention due to an enlarged prostate gland, must be carefully excluded. Indeed, I regard the habit of rising regularly at night to void urine—say, once, twice, or oftener—in men over middle age who are free from cystitis or enlarged prostate, as one of the very strongest indications of the presence of chronic Bright's disease. This symptom is but another evidence of increase of the circulatory forces. It means that the blood-pressure within the filtering mechanism of the kidney is being increased by the increasing power of the cardiac ventricle, and therefore more urine is being secreted than normal. These subjects rise at night to void urine, *not* because the bladder is irritable, but because the bladder is distended, and hence they void large quantities of urine each time they rise.

In concluding this part of the subject, it may be asked, If these accompanying conditions and symptoms are of the value attributed to them, should not their careful study enable the examiner to form a pretty accurate conclusion, in some cases at least, as to the presence of Bright's disease in-

dependent of the presence or absence of albuminuria? This question may be unhesitatingly answered in the affirmative. Thus, in the case of a man over forty years of age who has been a generous eater all his life, eating meat at most of his meals; if such a man rises regularly at night to void considerable quantities of urine of low specific gravity, and if his pulse is one of marked tension, and the second cardiac sound is distinctly increased, even though no albumin whatever is present in his urine, such a subject would be ineligible for life insurance, for the reason that he is undoubtedly suffering from chronic Bright's disease. It is well known now that Bright's disease without albuminuria is a frequent fact, and the above-mentioned circumstances are precisely those under which it occurs.

In 1885 * I collected and published the following facts upon this subject: "In *Guy's Hospital Reports* for 1879 (p. 367) may be found an analysis of 100 cases of granular kidneys observed in that hospital up to that time. Of the 100 cases noted, the very large proportion of 74 cases were characterized by the absence of albumin from the urine." Dr. Saundby, on *The Occurrence of Dropsy in Granular Kidney*, introduces a table showing the diagnosis, sent down from the wards to the post-mortem room at the Birmingham General Hospital, † in 98 cases, in all of which the kidneys proved to be granular. Out of these 98 cases, only 22 were sent down with the diagnosis of Bright's disease. We may therefore fairly assume that in 76 of the cases albumin was not found in the urine. Dr. Mahomed collected the records of 61 cases treated in Guy's Hospital during the two years 1879 and 1880. In 41 of these cases albumin was *never* discovered in the urine.

Now, adding these statistics together, we have 259 cases

* *Chicago Med. Journal and Examiner*, May, 1885.

† *Birmingham Medical Review*, April, 1881.

of chronic Bright's disease in which albumin was present in the urine only in 68 cases, leaving 191 cases—nearly 74 per cent.—in which albumin was absent. These cases can be open to little question, since they were all hospital cases subject to the usual rules of examination of the urine, and the diagnosis in all cases was established by the autopsies. It is this class of cases that has proved so unprofitable to life-insurance companies, and the medical examiner should be ever on the alert for them with the aid of the suggestions above laid down.

Pain.—Contrary to the popular lay impression, "pain in the back" forms no part of a scientific diagnosis of any form of Bright's disease. The kidneys may dwindle to mere rudiments under granular atrophy, or waste completely away under suppurative disease, without either state ever being made known through pain. In connection with albuminuria, therefore, it is unnecessary to dwell upon this symptom.

Nevertheless, pain bears very strongly upon other urinary disorders which are of special interest to medical examiners for life-insurance associations, notably gravel.

Sudden attacks of severe pain in the back, extending forward along the course of the ureter, with retraction of the testicle on the affected side, are significant of gravel, more especially if the attacks be so severe as to necessitate the use of anodynes for their relief.

Should entire freedom from pain exist between the attacks, we may pretty safely assume that no stone has lodged in the renal pelvis or urinary passages, while, on the other hand, if more or less backache exists between the severer attacks, and especially if the pain extends down the leg, we may pretty safely infer that one or more stones have lodged in the kidney or renal pelvis. The urinary sediment as already shown will afford evidence of the character

of the gravel present, and to some extent of the amount of damage it is causing.

If the applicant is subject to frequent attacks of gravel—occurring, say, every six or twelve months, even though no evidence exists that stone has lodged in the kidney or urinary tract—he would not be entitled to the privileges of insurance until at least five years had elapsed after his last attack of gravel. On the other hand, if there are reasons to believe that a stone has lodged in the kidney or renal pelvis, or even in the bladder, the application should be declined.

Sugar.—The presence of sugar in the urine is usually determined by some form of the copper test, most often Fehling's solution. The instability of sodic tartrate, which enters into Fehling's solution, renders the latter notoriously unstable, and consequently great annoyances and trouble arise in its use. That this test has so long held the lead in general use seems altogether singular in view of the above facts, more especially since it is a very simple matter to construct a permanent and equally trustworthy copper-test solution upon the same basis with slight alteration of the formula. Thus the following formula will, if prepared, furnish a solution corresponding exactly in strength and reactions with Fehling's test, and, being perfectly stable, it may be kept in stock indefinitely:

R _x Copper sulphate, pure.....	3 iv;
Caustic potash (in sticks).....	3 jss.;
Glycerin, pure.....	f 3 ij;
Distilled water to.....	Oj.

Prepare by dissolving the caustic potash in part of the water, and adding the glycerin. In another portion of the water dissolve the copper sulphate. Slowly mix the two solutions, and with distilled water bring the volume of the whole to one pint and filter.

In testing for sugar with this solution, proceed as with

Fehling's test, as follows: Pour into an ordinary test-tube about one fluidrachm of the test solution and add an equal amount of distilled water. Bring the whole to the boiling point, and, while gently boiling, add the suspected urine to the extent of half a drachm or more. If sugar is present in considerable quantities, the first few drops of urine will cause a yellowish precipitate of suboxide of copper which gradually deepens into red. If no such precipitate occurs after adding the urine to the extent of a drachm, sugar is absent.

A very excellent form of copper test for sugar in the urine, as well as exceedingly simple in preparation, is that devised by Professor Haines, of Chicago, as follows: Take of pure sulphate of copper, thirty grains; distilled water, half an ounce; make a perfect solution and add pure glycerin, one half fluidounce; mix thoroughly, and add five ounces of liquor potassæ. In testing with this solution, take about one fluidrachm and gently boil it in an ordinary test-tube. Next add from six to eight drops of the suspected urine and again gently boil. If sugar is present, a copious yellowish or yellowish-red precipitate is thrown down. If no such precipitate appear, sugar is absent. With this test not more than eight drops of urine must be added in testing.

With both these tests a whitish deposit is sometimes thrown down—phosphates of calcium and magnesium—in consequence of the strongly alkaline character of the test solutions. This should not be taken as an evidence of the presence of sugar.

It is well to bear in mind the fact that the copper tests are liable occasionally to lead to erroneous conclusions as to the presence of sugar in the urine. Certain normal constituents of the urine—notably uric acid, urates, creatinin, mucus, etc., as well as certain occasional constituents, such

as oxybutyric acid, urochloralic acid, uroleucic acid, and uroxanthic acid, as well as such drugs as tannin, morphine, salicylic acid, and carbolic acid—possess more or less reducing power over the copper tests.

The normal elements of the urine possess but feeble reducing powers over these tests, and therefore the errors just referred to are actually encountered but rarely. Since, however, such errors are possible, it is well in cases of doubt to appeal to such methods as may be considered absolutely trustworthy. Fortunately, we have in the phenylhydrazine test one that is entitled to be considered positive in its capability of detecting sugar. This test is most conveniently conducted as follows: First introduce in the bottom of an ordinary test-tube a layer of phenylhydrazine or its hydrochloride, say half an inch in thickness; upon this place another half inch of sodium acetate; next add water to one fourth the capacity of the tube; and, lastly, add sufficient of the suspected urine to half fill the test-tube. Gradually bring the whole to the boiling point and boil for about one minute, and then decant into a conical glass vessel and set aside to cool. When thoroughly cold, take up a few drops of the sediment from the bottom of the glass vessel with a pipette, and place them under the microscope. If sugar is present, very peculiar, yellow, acicular crystals will be readily seen—phenylglucosazone—which are altogether characteristic. They have a marked tendency to crystallize in stellate or rosette form, or in bundles, like sheaves of wheat. If no such crystals are to be seen after the test has stood for from six to twelve hours, it may be confidently stated that the urine is free from sugar. The round, yellow globules often seen are no evidence of sugar. This test reacts only with *glucose*, *maltose*, and *lactose*.

Having determined the presence of sugar in the urine,

it may be desirable to know the quantity thereof. This may be accurately determined by my quantitative method in about five minutes as follows: First prepare a test solution according to the following formula:

Sulphate of copper, pure.....	$\frac{1}{2}$ drachm;
Caustic potash, pure.....	$2\frac{1}{2}$ drachms;
Strong ammonia water (sp. gr. 0.9). ..	$5\frac{1}{2}$ fluidounces;
Glycerin, pure.....	6 fluidrachms;
Distilled water to.....	1 pint.

Dissolve the copper sulphate in part of the water and add the glycerin. In another portion of the water dissolve the caustic potash. Slowly mix the two solutions and add the ammonia. Finally, with distilled water, bring the volume of the whole to one pint and filter.

The test should be applied as follows: Into a four-ounce glass flask pour thirty cubic centimetres (about $f \frac{7}{8} j$) of the test solution and add an equal bulk of distilled water, and bring the whole to the boiling point over a spirit lamp. A pipette graduated in minims and holding not less than half a drachm is now filled with the saccharine urine to be tested, and while the solution is boiling the urine is slowly discharged from the pipette, drop by drop, into the test solution until the blue color completely vanishes and leaves the solution perfectly colorless and clear. The number of minims it takes to discharge the blue color of the solution contain just one fourth of a grain of sugar. By multiplying this number of minims until the product is four hundred and eighty, the multiple represents the number of quarter grains of sugar to the ounce, which, if divided by four, gives the number of grains of sugar in each ounce of the urine submitted to the test.

In testing, the solution should be raised to the boiling point and kept slowly boiling, while the urine should be slowly added drop by drop, about five seconds elapsing

after the addition of each drop until the blue color *begins to fade*; then the drops should be added still more slowly in order that the precise quantity may be determined that causes complete decoloration.

After testing, the test solution slowly resumes its blue color upon cooling, owing to absorption of oxygen from the atmosphere, and reforming of the blue protoxide of copper from the suboxide held in solution by the ammonia. The most accurate results are reached, as well as the greatest convenience attained, in testing by means of an apparatus consisting of a glass retort and stand with graduated burette.

Significance of Sugar in the Urine.—It may be safely stated that, if sugar be found in the urine of the applicant, the risk should be unhesitatingly declined. It is true that most authors recognize a so-called harmless form of glycosuria, as well as the severer grades of diabetes; but it is also true that either form may pass into the other at any time during its course. Advanced observers upon the subject are rapidly tending toward the conclusion that in all cases sugar in the urine is symptomatic of grave disease of either the brain, liver, or pancreas. It is true that all cases are not progressive, but a large percentage of them are, and that toward a fatal termination, and any case may become rapidly so at any time. It has been truly said that “a man with sugar in his urine is like a house that is undermined”; we may be assured that it will fall, but the precise time when it will fall no one can tell. To accept a glycosuric applicant for life insurance because his case is a mild one, or because only *small quantities* of sugar are found in his urine, would be in no wise safer than to accept a subject of chronic Bright’s disease because the albuminuria was of a mild grade. It is the morbid condition back of the abnormal urine, and not the latter itself, that constitutes

the danger, and this danger is often as positively indicated by a small as by a large amount of the abnormal products found in the urine.

Microscopic Examination of the Urine.—In conducting microscopic examinations of the urine for life insurance, it is absolutely necessary not only that the urine should be freshly voided, but also that it should be kept strictly from decomposition until examined. Casts, epithelium, and pus corpuscles rapidly undergo desiccation in decomposing urine, so that their diagnostic features soon become indistinct or altogether obliterated, and, moreover, the microscopic field is likely to become clouded by bacteria, thus rendering a satisfactory examination impossible. In order to avoid these complications, the medical examiner is advised to proceed as follows: Having procured a freshly voided sample of urine, it should be charged with the resorcin solution already described. Pour into the bottom of a conical glass vessel about a fluidrachm of the resorcin solution, and, after inverting the bottle containing the urine two or three times, decant about three ounces of the latter into the conical glass, carefully cover the glass, and set aside undisturbed for twenty-four hours. At the end of that time take up from the bottom of the conical glass two or three drops of the urinary sediment by means of a nipple pipette, and place them on a perfectly clean glass slide, preferably one with a shallow cell in the center. Carefully adjust a clean cover glass over the cell in such a manner as to avoid the presence of air bubbles, and examine the field under a quarter-inch objective.

In scanning the microscopic field it should be borne in mind that the most difficult objects to find, as well as the most important, are the perfectly clear hyaline casts. So entirely transparent are these structures that, with too much or too direct illumination, they often remain undiscoverable,

even in the center of the field. By so adjusting the sub-stage mirror of the microscope that the rays of light are thrown very obliquely across the field—so obliquely, in fact, that much of the light is shut out—the shadows of the casts will often appear, or perhaps the marginal outlines of the casts themselves may be discerned. Now, by careful focusing by means of the fine adjustment-screw, these important objects may be brought quite plainly into view.

Sometimes, with all these precautions, hyaline casts remain indistinct in parts of their outlines, leaving doubts in the mind as to the true nature of the objects seen. In such cases, by slightly pressing upon both ends of the glass slide, slight currents will be created in the urine between the slide and the cover-glass, causing the cast to move and often to roll over, and the changed position of the cast often enables one to recognize its true character at once.

By attention to the above-mentioned details all the morbid products in the urine will be more easily found. The granular, epithelial, and blood casts are usually quite readily found; in fact, they are not easily overlooked if the instrument is properly focused.

In addition to casts in the urine, blood-corpuscles and free renal epithelia should be carefully sought for and noted when found. Certain inorganic products should likewise be sought for, more especially the brownish-colored rhombs and six-sided plates of uric acid, the envelope-shaped crystals of calcium oxalate, and, above all, the triangular prisms and star-shaped feathery crystals of triple phosphates.

Significance of Urinary Sediments.—By most authorities renal casts are considered to be the crucial test of organic changes in the kidneys. In a positive sense this may be accepted as strictly true, and, therefore, in all cases the

discovery of renal casts in the urine renders the applicant ineligible for life insurance.

It must not always be concluded, however, that because no casts are found, the kidneys are free from disease. It has already been shown that some casts—notably hyaline ones—are notoriously difficult to find, and they therefore sometimes escape discovery.

In those cases in which other symptoms point strongly toward renal disease the failure to find casts must not be allowed to carry too much negative weight.

Pus corpuscles when present are often valuable guides in the construction of a diagnosis. They may explain the source of a slight albuminuria when the kidneys are perfectly sound, as evidenced by otherwise normal conditions of the urine. On the other hand, when associated with deposits of triple phosphates in the urine, pus corpuscles guide us pretty accurately to a diagnosis of cystitis.

If considerable deposits of uric-acid crystals are found in the urine, special inquiry should be made with the view of ascertaining any history of severe attacks of pain in the back. Should such attacks be of frequent or occasional occurrence, under the circumstances the applicant is clearly the subject of attacks of uric-acid gravel, and therefore ineligible for life insurance. Should a considerable deposit of calcium-oxalate crystals be found, associated with the same symptoms—viz., severe attacks of pain in the back with retraction of the testicle on the affected side—we may conclude that the applicant is a subject of oxalic gravel which would debar him from acceptance.

Of the triple phosphate prisms nothing further need be added save to say that they are nearly always associated with pus corpuscles, and indicate pathological states of the bladder that debar the applicant from life insurance.

Rules.

1. If albumin is found in the urine, do not recommend the applicant for insurance because the quantity of albumin present is small, even though it be mere traces.

2. If albumin is present in the urine and the applicant is over forty years of age, decline the application.

3. If albumin and renal casts are found in the urine, decline the application regardless of the age of the applicant or the quantity of albumin present.

4. If albumin is found in the urine in large amounts—two or more grammes to the litre—decline the application.

5. If the applicant is of middle age or over and has always been a generous eater, especially of meat; and if he rises regularly at night to void considerable quantities of clear urine of low specific gravity; and if, in addition, there is decided tension of his pulse with accentuation of the second sound of the heart, decline the application even though the urine is free from albumin.

6. If true renal casts are unmistakably present in the urine, either epithelial, granular, fatty, hyaline, or composite, decline the application even though the urine is free from albumin.

7. If the specific gravity of the urine is normal (1.020) or above, but it contains albumin at times while at other times it contains none, especially on rising in the morning, and no casts are present in the urine of an applicant who is under thirty years of age and apparently in good health, the albuminuria is doubtless of the so-called functional form, and, in the discretion of the home office, the application may be accepted for a ten-years' endowment policy. As yet, however, such risks can not be considered altogether safe for life policies.

8. If the applicant is subject to frequent or occasional attacks of gravel—one or more of which was recent—the application should be declined.

9. If the applicant has had one or more attacks of gravel and more or less dull pain is present in the renal region, and the urine is more or less turbid from the presence of pus, the application should be declined.

10. If the applicant has had attacks of gravel, but five years have elapsed since the last attack, the urine remaining perfectly normal, and no pain is present in the region of the kidney, the application may be accepted.

11. If the applicant is over fifty years of age and voids his urine with more or less slowness and difficulty at times, the stream being small, forked, or dropping, and at times involuntarily shutting off before the finish, and if he rises regularly at night to void urine and is subject to periodical attacks of frequent urination, the application should be declined, even though the urine itself is in every respect normal.

12. If the urine contains sugar, the application should be declined.

13. If the urine is turbid from admixture with pus or blood, the application should be declined.



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